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FINAL REPORT
JANUARY 1990

REPORT NO. EVT 1-90

MIL-STD-1660 TESTS OF
COMBINATION WOODEN SPECIES
USED FOR
FABRICATING MIL-P-15011 PALLETS

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VALIDATION ENGINEERING DIVISION
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U.S. ARMY DEFENSE AMMUNITION CENTER AND SCHOOL
VALIDATION ENGINEERING DIVISION
SAVANNA, IL 61074-9639

REPORT NO. EVT 1-90
MIL-STD-1660 TESTS OF
COMBINATION WOODEN SPECIES USED FOR
FABRICATING MIL-P-15011 PALLETS

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PART 1

INTRODUCTION

A. BACKGROUND. The U.S. Army Defense Ammunition Center and School (USADACS), Validation Engineering Division (SMCAC-DEV), was tasked by the U.S. Army Armament Research, Development and Engineering Center (ARDEC), SMCAR-ESK, to test combination wooden pallets made from oak and pine in configurations specified in MIL-P-15011. The hybrid consisted of an oak base and stringers with a pine deck. Three pallet sizes (40- by 48-inches, 42- by 53-inches, and 35- by 45 1/2-inches) were tested to the test requirements of MIL-STD-1660, Design Criteria for Ammunition Unit Loads.

B. AUTHORITY. This test was conducted in accordance with mission responsibilities delegated by the U.S. Army Armament, Munitions and Chemical Command (AMCCOM), Rock Island, IL.

C. OBJECTIVE. The objective of these tests was to determine if softwood pallet decks such as pine would perform equally to oak hardwood decks as required by MIL-P-15011. Replacing oak decks with pine will result in a material cost savings. To be considered acceptable, the pine deck pallets must satisfy the testing requirements of MIL-STD-1660, Design Criteria for Ammunition Unit Loads.

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Justification	
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Date	1981
A-1	



PART 2

MIL-STD-1660 TESTS OF
COMBINATION WOODEN SPECIES USED FOR
FABRICATING MIL-P-15011 PALLETS

JANUARY 1990

TEST ATTENDEES

NAME AND PHONE NUMBER

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Director
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and School
ATTN: SMCAC-DEV
Savanna, IL 61074-9639

PART 3

TEST PROCEDURES

The test procedures outlined in this section were extracted from MIL-STD-1660, Design Criteria for Ammunition Unit Loads, 8 April 1977. This standard identifies five steps that a unitized load must undergo if it is considered to be acceptable. These tests are synopsized below:

1. STACKING TESTS. The unit load shall be loaded to simulate a stack of identical unit loads stacked 16 feet high for a period of one hour. This stacking load is simulated by subjecting the unit load to a compression of weight equal to an equivalent 16-foot stacking height. The compression load is calculated in the following manner. The unit load weight is divided by the unit load height in inches and multiplied by 192. The resulting number is the equivalent compressive force of a 16-foot-high load.

2. LOOSE CARGO TRANSPORTATION TEST. This test shall be conducted in accordance with Method 5019, Federal Standard 101. The test procedure is as follows: The test specimen shall be placed on, but not fastened to, the platform. With the specimen in one position, vibrate the platform at 1/2-inch amplitude (1-inch double amplitude) starting at a frequency of about 3 cycles-per-second. Steadily increase the frequency until the package leaves the platform. The resonant frequency is achieved when a 1/16-inch-thick feeler may be momentarily slid freely between every point on the specimen in contact with the platform at some instance during the cycle, or a platform acceleration achieves $1 \pm 0.1G$. Midway into the testing period, the specimen shall be rotated 90 degrees, and the test continued for the duration. If failure occurs, the total time of vibration shall be two hours if the specimen is tested in one position; and, if tested in more than one position, the total time shall be three hours.

3. EDGEWISE ROTATIONAL DROP TEST. This test shall be conducted by using the procedures of Method 5008, Federal Standard 101. The procedure for this test is as follows: The specimen shall be placed on its bottom with one end of the base of the container supported on a sill 6 inches high. The height of the sill shall be increased, if necessary, to ensure that there will be no support for the base between the ends of the container when dropping takes place, but should not be high enough to cause the container to slide on the supports when the dropped end is raised for the drops. The unsupported end of the container shall then be raised and allowed to fall freely to the concrete, pavement, or similar underlying surface from a prescribed height. Unless otherwise specified, the height of drop for level A protection shall conform to the following tabulation:

GROSS WEIGHT NOT EXCEEDING	DIMENSIONS ON ANY EDGE NOT EXCEEDING	HEIGHT OF DROP LEVEL A PROTECTION
Pounds	Inches	Inches
600	72	36
3,000	no limit	18
4,000	no limit	12

4. IMPACT TEST. This test shall be conducted by using the procedure of Method 5023, Incline-Impact Test of Federal Standard 101. The procedure for the Incline-Impact Test is as follows: The specimen shall be placed on the carriage with the surface or edge which is to be impacted projecting at least two inches beyond the front end of the carriage. The carriage shall be brought to a predetermined position on the incline and released. If it is desired to concentrate the impact on any particular position on the container, a 4- by 4-inch timber may be attached to the bumper in the desired position before the test. No part of the timber shall be struck by the carriage. The position of the container on the carriage and the sequence in which surfaces and

edges are subjected to impacts may be at the option of the testing activity and will depend upon the objective of the tests. When the test is to determine satisfactory requirements for a container or pack, and, unless otherwise specified, the specimen shall be subjected to one impact on each surface that has each dimension less than 9.5 feet. Unless otherwise specified, the velocity at time of impact shall be 7-feet-per-second.

5. DISASSEMBLY TEST. Following all rough handling tests, the unit load may be squared up within two inches of its original shape and on a flat level surface. The strapping shall then be cut and removed from the palletized load. Assembly of the load shall be such that it retains its unity upon removal of the strapping.

PART 4

TEST EQUIPMENT

1. COMPRESSION TESTER.

- a. Manufacturer: Ormond Scientific
- b. Platform: 60 inches by 60 inches
- c. Compression Limit: 50,000 pounds
- d. Tension Limit: 50,000 pounds

2. TRANSPORTATION SIMULATOR.

- a. Manufacturer: Gaynes Laboratory
- b. Capacity: 5,000-pound pallet
- c. 1/2-inch Amplitude
- d. Speed: 50 to 300 rpm
- e. Platform: 5 foot by 8 foot

3. INCLINED RAMP.

- a. Manufacturer: Conbur Incline
- b. Impact Tester
- c. 10 Percent Incline
- d. 12-Foot Ramp

PART 5

TEST RESULTS

PALLET SAMPLE NO. 1A

1. TEST SPECIMEN.

- a. Width: 42 inches
- b. Length: 53 inches
- c. Height: 48 1/2 inches
- d. Weight: 4,100 pounds

2. STACKING TEST.

- a. Test Load 16,400 pounds
- b. Applied test load duration 60 minutes
- c. Observations: No damage to the pallet or M548 cans.

3. LOOSE CARGO TRANSPORTATION TEST.

- a. Longitudinal orientation.
 - 1. Operating speed 200 rpm
 - 2. Test Duration 90 minutes
 - 3. Observations: Cracked strapping board.
- b. Lateral orientation.
 - 1. Operating speed 200 rpm
 - 2. Test Duration 90 minutes
 - 3. Observations: Outside deck boards pulling out from base.

4. EDGEWISE ROTATIONAL DROP TEST.

- a. Side 1
 - 1. Drop Height 12 inches
 - 2. Unit orientation lateral
 - 3. Observations: Padded Sling broke into pallet deck board.
- b. Side 2
 - 1. Drop Height 12 inches
 - 2. Drop orientation longitudinal

- 3. Observations: No visible damage.
- c. Side 3
 - 1. Drop Height 12 inches
 - 2. Drop orientation lateral
 - 3. Observations: Padded sling broke into pallet deck board.
- d. Side 4.
 - 1. Drop Height 12 inches
 - 2. Drop Orientation longitudinal
 - 3. Observations: No visible damage.

5. INCLINE-IMPACT TEST.

- a. Drop height for all impacts 7
- b. Side 1
 - 1. Orientation Lateral
 - 2. Observations: No visible damage to the pallet or load.
- c. Side 2
 - 1. Orientation Longitudinal
 - 2. Observations: No visible damage to the pallet or load.
- d. Side 3
 - 1. Orientation Lateral
 - 2. Observations: No visible damage to the pallet or load.
- e. Side 4
 - 1. Orientation Longitudinal
 - 2. Observations: No visible damage to the pallet or load.

6. DISASSEMBLY OBSERVATIONS.

Unit load remained stable when all strapping and dunnage was removed after testing.

PALLET SAMPLE NO. 1B

1. TEST SPECIMEN.

- a. Width: 42 inches
- b. Length: 53 inches
- c. Height: 48 1/2 inches
- d. Weight: 4,100 pounds

2. STACKING TEST.

- a. Test Load 16,200 pounds
- b. Applied test load duration 60 minutes
- c. Observations: No damage to the pallet or M548 cans.

3. LOOSE CARGO TRANSPORTATION TEST.

- a. Longitudinal orientation.
 - 1. Operating speed 185 rpm
 - 2. Test Duration 90 minutes
 - 3. Observations: Cracked strapping board.
- b. Lateral orientation.
 - 1. Operating speed 210 rpm
 - 2. Test Duration 90 minutes
 - 3. Observations: Outside deck boards loosened from base.

4. EDGEWISE ROTATIONAL DROP TEST.

- a. Side 1
 - 1. Drop Height 12 inches
 - 2. Unit orientation lateral
 - 3. Observations: No visible damage.
- b. Side 2
 - 1. Drop Height 12 inches
 - 2. Drop orientation longitudinal
 - 3. Observations: No visible damage.
- c. Side 3
 - 1. Drop Height 12 inches
 - 2. Drop orientation lateral

- 3. Observations: No visible damage.
- d. Side 4.
 - 1. Drop Height 12 inches
 - 2. Drop Orientation longitudinal
 - 3. Observations: No visible damage.

5. INCLINE-IMPACT TEST.

- a. Drop height for all impacts 7
- b. Side 1
 - 1. Orientation Lateral
 - 2. Observations: No visible damage to the pallet or load.
- c. Side 2
 - 1. Orientation Longitudinal
 - 2. Observations: No visible damage to the pallet or load.
- d. Side 3
 - 1. Orientation Lateral
 - 2. Observations: No visible damage to the pallet or load.
- e. Side 4
 - 1. Orientation Longitudinal
 - 2. Observations: No visible damage to the pallet or load.

6. DISASSEMBLY OBSERVATIONS.

Unit load remained stable when all strapping and dunnage was removed after testing.

PALLET SAMPLE NO. 2A

1. TEST SPECIMEN.

- a. Width: 40 inches
- b. Length: 48 inches
- c. Height: 48 1/2 inches
- d. Weight: 4,014 pounds

2. STACKING TEST.

- a. Test Load 16,000 pounds
- b. Applied test load duration 60 minutes
- c. Observations: No damage to the pallet or M548 cans.

3. LOOSE CARGO TRANSPORTATION TEST.

- a. Longitudinal orientation.
 - 1. Operating speed 75 rpm
 - 2. Test Duration 90 minutes
 - 3. Observations: Cracked strapping board.
- b. Lateral orientation.
 - 1. Operating speed 180 rpm
 - 2. Test Duration 90 minutes
 - 3. Observations: Outside deck boards pulling out from base.

4. EDGEWISE ROTATIONAL DROP TEST.

- a. Side 1
 - 1. Drop Height 12 inches
 - 2. Unit orientation lateral
 - 3. Observations: Padded Sling broke into pallet deck board.
- b. Side 2
 - 1. Drop Height 12 inches
 - 2. Drop orientation longitudinal
 - 3. Observations: No visible damage.
- c. Side 3
 - 1. Drop Height 12 inches
 - 2. Drop orientation lateral

3. Observations: Padded sling broke into pallet deck board.
- d. Side 4.
 1. Drop Height 2 inches
 2. Drop Orientation longitudinal
 3. Observations: No visible damage.

5. INCLINE-IMPACT TEST.

- a. Drop height for all impacts 7
- b. Side 1
 1. Orientation Lateral
 2. Observations: No visible damage to the pallet or load.
- c. Side 2
 1. Orientation Longitudinal
 2. Observations: No visible damage to the pallet or load.
- d. Side 3
 1. Orientation Lateral
 2. Observations: No visible damage to the pallet or load.
- e. Side 4
 1. Orientation Longitudinal
 2. Observations: No visible damage to the pallet or load.

6. DISASSEMBLY OBSERVATIONS.

Unit load remained stable when all strapping and dunnage was removed after testing.

PALLET SAMPLE NO. 2B

1. TEST SPECIMEN.

- a. Width: 40 inches
- b. Length: 8 inches
- c. Height: 48 1/2 inches
- d. Weight 4,000 pounds

2. STACKING TEST.

- a. Test Load 16,000 pounds
- b. Applied test load duration 60 minutes
- c. Observations: No damage to the pallet or M548 cans.

3. LOOSE CARGO TRANSPORTATION TEST.

- a. Longitudinal orientation.
 - 1. Operating speed 240 rpm
 - 2. Test Duration 90 minutes
 - 3. Observations: Cracked strapping board.
- b. Lateral orientation.
 - 1. Operating speed 200 rpm
 - 2. Test Duration 90 minutes
 - 3. Observations: Outside deck boards pulling out from base.

4. EDGEWISE ROTATIONAL DROP TEST.

- a. Side 1
 - 1. Drop Height 12 inches
 - 2. Unit orientation lateral
 - 3. Observations: No visible damage.
- b. Side 2
 - 1. Drop Height 12 inches
 - 2. Drop orientation longitudinal
 - 3. Observations: No visible damage.
- c. Side 3
 - 1. Drop Height 12 inches
 - 2. Drop orientation lateral

- 3. Observations: No visible Damage.
- d. Side 4.
 - 1. Drop Height 12 inches
 - 2. Drop Orientation longitudinal
 - 3. Observations: No visible damage.

5. INCLINE-IMPACT TEST.

- a. Drop height for all impacts 7
- b. Side 1
 - 1. Orientation Lateral
 - 2. Observations: No visible damage to the pallet or load.
- c. Side 2
 - 1. Orientation Longitudinal
 - 2. Observations: No visible damage to the pallet or load.
- d. Side 3
 - 1. Orientation Lateral
 - 2. Observations: No visible damage to the pallet or load.
- e. Side 4
 - 1. Orientation Longitudinal
 - 2. Observations: No visible damage to the pallet or load.

6. DISASSEMBLY OBSERVATIONS.

Unit load remained stable when all strapping and dunnage was removed after testing.

PALLET SAMPLE NO. 3A

1. TEST SPECIMEN.

- a. Width: 35 inches
- b. Length: 45 1/2 inches
- c. Height: 48 inches
- d. Weight: 3,620 pounds

2. STACKING TEST.

- a. Test Load 14,000 pounds
- b. Applied test load duration 60 minutes
- c. Observations: No damage to the pallet or M548 cans.

3. LOOSE CARGO TRANSPORTATION TEST.

- a. Longitudinal orientation.
 - 1. Operating speed 220 rpm
 - 2. Test Duration 90 minutes
 - 3. Observations: Cracked skid.
- b. Lateral orientation.
 - 1. Operating speed 200 rpm
 - 2. Test Duration 90 minutes
 - 3. Observations: Re-strapped unit.

4. EDGEWISE ROTATIONAL DROP TEST.

- a. Side 1
 - 1. Drop Height 18 inches
 - 2. Unit orientation lateral
 - 3. Observations: No visible damage to pallet or load
- b. Side 2
 - 1. Drop Height 18 inches
 - 2. Drop orientation longitudinal
 - 3. Observations: No visible damage.
- c. Side 3
 - 1. Drop Height 18 inches
 - 2. Drop orientation lateral

- 3. Observations: No visible damage.
- d. Side 4.
 - 1. Drop Height 18 inches
 - 2. Drop Orientation longitudinal
 - 3. Observations: No visible damage.

5. INCLINE-IMPACT TEST.

- a. Drop height for all impacts 7
- b. Side 1
 - 1. Orientation Lateral
 - 2. Observations: No visible damage to the pallet or load.
- c. Side 2
 - 1. Orientation Longitudinal
 - 2. Observations: No visible damage to the pallet or load.
- d. Side 3
 - 1. Orientation Lateral
 - 2. Observations: No visible damage to the pallet or load.
- e. Side 4
 - 1. Orientation Longitudinal
 - 2. Observations: No visible damage to the pallet or load.

6. DISASSEMBLY OBSERVATIONS.

Unit load remained stable when all strapping and dunnage was removed after testing.

PALLET SAMPLE NO. 3B

1. TEST SPECIMEN.

- a. Width: 35 inches
- b. Length: 45 1/2 inches
- c. Height: 48 inches
- d. Weight: 3,670 pounds

2. STACKING TEST.

- a. Test Load 14,500 pounds
- b. Applied test load duration 60 minutes
- c. Observations: No damage to the pallet or M548 cans.

3. LOOSE CARGO TRANSPORTATION TEST.

- a. Longitudinal orientation.
 - 1. Operating speed 215 rpm
 - 2. Test Duration 90 minutes
 - 3. Observations: Cracked skid.
- b. Lateral orientation.
 - 1. Operating speed 190 rpm
 - 2. Test Duration 90 minutes
 - 3. Observations: No visible damage.

4. EDGEWISE ROTATIONAL DROP TEST.

- a. Side 1
 - 1. Drop Height 18 inches
 - 2. Unit orientation lateral
 - 3. Observations: No visible damage to pallet or load
- b. Side 2
 - 1. Drop Height 18 inches
 - 2. Drop orientation longitudinal
 - 3. Observations: No visible damage.
- c. Side 3
 - 1. Drop Height 18 inches
 - 2. Drop orientation lateral

- 3. Observations: No visible damage.
- d. Side 4.
 - 1. Drop Height 18 inches
 - 2. Drop Orientation longitudinal
 - 3. Observations: No visible damage.

5. INCLINE-IMPACT TEST.

- a. Drop height for all impacts 7
- b. Side 1
 - 1. Orientation Lateral
 - 2. Observations: No visible damage to the pallet or load.
- c. Side 2
 - 1. Orientation Longitudinal
 - 2. Observations: No visible damage to the pallet or load.
- d. Side 3
 - 1. Orientation Lateral
 - 2. Observations: No visible damage to the pallet or load.
- e. Side 4
 - 1. Orientation Longitudinal
 - 2. Observations: No visible damage to the pallet or load.

6. DISASSEMBLY OBSERVATIONS.

Unit load remained stable when all strapping and dunnage was removed after testing.

PART 6

CONCLUSIONS AND RECOMMENDATIONS

1. CONCLUSIONS:

a. The unit configurations satisfactorily remained intact throughout testing. During the transportation simulation portion of testing, samples nos. 1 (42-by 53-inch) and 2 (40-by 48-inch) experienced cracked strapping boards and separation of the skids from the posts.

b. Uncovered portions of the pine deck were damaged when the unit load was raised with a sling to perform the edgewise rotational drop test. When lifting for this test, the thickness edge of the outside deck board experienced a high compressive load force from the lifting sling. This load force exceeded the compressional load limit of the lumber. In normal transportation situations, slings would be placed under loaded parts of the pallet deck. As a result, the breakage experienced during testing would not normally occur in the field. The damage to the unit loads, caused by lifting at an unsupported portion of the pallet deck, did not result in a MIL-STD-1660 failure.

2. RECOMMENDATIONS. It is recommended that the pine deck pallets manufactured to MIL-P-15011 specifications be used for shipment and storage of ammunition. However, further investigation is required to determine if the pine deck is equivalent to an oak deck in terms of environmental durability on a long-term basis.

PART 7

UNITIZATION DRAWINGS

APPENDIX 15C

UNITIZATION PROCEDURES FOR BOXED AMMUNITION AND COMPONENTS ON 4-WAY ENTRY PALLETS

CARTRIDGE, 20MM, PACKED VARIOUS QUANTITIES
PER M548 METAL BOX, UNITIZED 24 BOXES PER
40" X 48" PALLET; APPROX BOX SIZE $18\frac{19}{32}$ " L X
 $8\frac{19}{64}$ " W X $14\frac{19}{32}$ " H

① HAZARD CLASSIFICATION DATA CONTAINED IN THE CHART AT LEFT IS FOR GUIDANCE AND INFORMATIONAL PURPOSES ONLY. VERIFICATION OF THE SPECIFIED DATA SHOULD BE MADE BY CONSULTING THE MOST RECENT JOINT HAZARD CLASSIFICATION SYSTEM LISTING OR OTHER APPROVED LISTING(S).

PALLET UNIT DATA						
ITEMS INCLUDED		HAZARD CLASSIFICATION ①				WEIGHT (LBS)
NSN	DOD IC	DOT CLASS	CG CLASS	QD CLASS	COMP GROUP	
1305-						
00-785-2829	A651	C	I	1.4	C	3,981
00-522-3700	A651	C	I	1.4	C	3,981
00-935-6171	A659	A	IV	(04) 1.2	E	3,981
00-143-6919	A769	A	IV	(04) 1.2	E	3,189
00-143-6918	A770	A	IV	(04) 1.2	E	3,189
00-926-9278	A791	A	IV	(04) 1.2	E	3,981
00-143-7050	A813	A	IV	(04) 1.2	G	3,189
00-143-7049	A814	A	IV	(04) 1.2	G	3,189
00-180-9270	A833	A	IV	(04) 1.2	E	3,189
00-180-9271	A834	A	IV	(04) 1.2	E	3,189
00-143-7176	A835	A	IV	(04) 1.2	E	3,189
00-143-7177	A836	A	IV	(04) 1.2	E	3,189
00-143-7167	A846	A	IV	(04) 1.2	G	3,189
00-112-0491	A865	A	IV	(04) 1.2	E	3,189
00-112-0494	A865	A	IV	(04) 1.2	E	3,189
00-112-0492	A866	A	IV	(04) 1.2	E	3,189
00-112-0493	A866	A	IV	(04) 1.2	E	3,189
00-935-9104	A890	A	IV	(04) 1.2	E	3,981
00-935-2019	A892	C	I	1.4	C	3,981
00-799-8669	A924	—	—	—	—	3,981
01-116-3923	A924	—	—	—	—	3,501
01-116-3931	A890	A	IV	(04) 1.2	E	3,981
01-116-3930	A892	C	I	1.4	C	3,981
00-752-8114	A891	C	I	1.4	C	3,525
01-116-4560	A891	C	I	1.4	C	3,525
01-118-9928	A890	A	IV	(04) 1.2	E	3,981
01-118-9930	A651	C	I	1.4	C	3,981
01-118-9929	A659	A	IV	(04) 1.2	E	3,981

THIS APPENDIX SUPERSEDES THE TWO-LAYER UNITIZATION PROCEDURES OF INTERIM DRAWING 19-48-4141-20PA1003, DATED FEBRUARY 1977.

DO NOT SCALE

REVISIONS

REVISION NO. 1, DATED NOVEMBER 1981, CONSISTS OF:

1. ADDING NATIONAL STOCK NUMBER TO THE "PALLET UNIT DATA" CHART.
2. REDESIGNING "FILLER ASSEMBLY".

REVISION NO. 2, DATED NOVEMBER 1982, CONSISTS OF:
ADDING NOTE "J" TO GENERAL NOTES SECTION ON PAGE 2.

REVISION NO. 3, DATED DECEMBER 1983, CONSISTS OF:

1. CHANGING BOX DIMENSIONS.

NOTICE: THIS APPENDIX CANNOT STAND ALONE BUT MUST BE USED IN CONJUNCTION WITH THE BASIC UNITIZATION PROCEDURES DRAWING 19-48-4116-20PA1002.

REVISIONS			APPROVED	FILED
1	NOV 81	<i>John L. Boyd</i>	<i>WRF/MBT</i>	<i>WRF/MBT</i>
2	NOV 82	<i>John L. Boyd</i>	<i>WRF/MBT</i>	<i>WRF/MBT</i>
3	DEC 83	<i>John L. Boyd</i>	<i>WRF/MBT</i>	<i>WRF/MBT</i>
			U.S. ARMY DARCOM DRAWING	
			JUNE 1981	
			CLASS	ISSUANCE
			19	48
			4116/	20PA
			15C	1002

SEAL FOR 1-1/4" STRAPPING (6 REQD, 1 PER STRAP). CRIMP EACH SEAL WITH TWO PAIR OF NOTCHES.

TIEDOWN STRAP, 1-1/4" X .035" OR .031" X 12'-8" LONG STEEL STRAPPING (4 REQD). SEE GENERAL NOTE "D" AT RIGHT.

LOAD STRAP, (ALTERNATE FOR HORIZONTAL STRAP), 1-1/4" X .035" OR .031" X 14'-2" LONG STEEL STRAPPING. THREAD LOAD STRAPS THRU PALLET STRAP SLOTS.

SUPPORT GATE (2 REQD). SEE DETAIL BELOW. STAPLE HORIZONTAL AND TIEDOWN STRAPS TO SUPPORT GATE AS SHOWN.

40" X 48" PALLET.

HORIZONTAL STRAP, 1-1/4" X .035" OR .031" X 16'-0" LONG STEEL STRAPPING (2 REQD). SEE GENERAL NOTE "C" AT RIGHT.

TYPICAL LOCATION FOR SECUREMENT OF A STRAP CUTTER. SEE GENERAL NOTE "F" AT RIGHT.

PALLET UNIT

SEE GENERAL NOTE "B" AT RIGHT.

24 BOXES OF 20MM CARTRIDGE (200 PER BOX) @ 160 LBS	3,840 LBS (APPROX)
DUNNAGE	61 LBS
PALLET	80 LBS
TOTAL WEIGHT	3,981 LBS (APPROX)
CUBE	40.0 CU FT (APPROX)

GENERAL NOTES

- THIS APPENDIX CANNOT STAND ALONE BUT MUST BE USED IN CONJUNCTION WITH THE BASIC UNITIZATION PROCEDURES DRAWING 19-48-4116-20PA1002. TO PRODUCE AN APPROVED UNIT LOAD, ALL PERTINENT PROCEDURES, SPECIFICATIONS AND CRITERIA SET FORTH WITHIN THE BASIC DRAWING WILL APPLY TO THE PROCEDURES DELINEATED IN THIS APPENDIX. ANY EXCEPTIONS TO THE BASIC PROCEDURES ARE SPECIFIED IN THIS APPENDIX.
- DIMENSIONS, CUBE AND WEIGHT OF A PALLET UNIT WILL VARY SLIGHTLY DEPENDING UPON THE ACTUAL DIMENSIONS OF THE BOXES AND THE WEIGHT OF THE SPECIFIC ITEM BEING UNITIZED.
- INSTALL EACH HORIZONTAL STRAP TO ENCIRCLE EACH LAYER OF BOXES ON THE PALLET AND TO BE ALIGNED WITH THE HORIZONTAL PIECES OF THE "SUPPORT GATE" AS SHOWN. HORIZONTAL STRAPS MUST BE TENSIONED AND SEALED PRIOR TO APPLICATION OF TIEDOWN STRAPS.
- INSTALL EACH TIEDOWN STRAP TO PASS UNDER THE TOP DECK BOARDS OF THE PALLET AND TO BE ALIGNED WITH THE VERTICAL PIECES OF THE "SUPPORT GATE" AS SHOWN. TIEDOWN STRAPS WILL NOT BE APPLIED UNTIL THE HORIZONTAL STRAPS HAVE BEEN TENSIONED AND SEALED.
- THE FOLLOWING DARCOM DRAWINGS ARE APPLICABLE FOR OUTLOADING AND STORAGE OF THE ITEMS COVERED BY THIS APPENDIX.

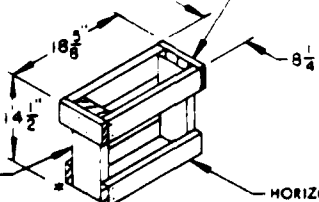
CARLOADING	DRAWING 19-48-4115-SPA1002
TRUCKLOADING	DRAWING 19-48-4117-11PA1003
STORAGE	DRAWING 19-48-4118-1-2-3-4-14-22PA1002
- FOR METHOD OF SECURING A STRAP CUTTER TO THE PALLET UNIT, SEE DARCOM DRAWING 19-48-4127-20P1000.
- IF ITEMS COVERED HEREIN ARE UNITIZED PRIOR TO ISSUANCE OF THIS APPENDIX, THE BOXES NEED NOT BE REUNITIZED SOLELY TO CONFORM TO THIS APPENDIX.
- THE UNITIZATION PROCEDURES DEPICTED HEREIN MAY ALSO BE USED FOR UNITIZING 20MM CARTRIDGES WHEN IDENTIFIED BY DIFFERENT NATIONAL STOCK NUMBERS (NSN) THAN WHAT IS SHOWN ON THE TITLE PAGE, PROVIDED THE BOX PACK DOES NOT VARY FROM WHAT IS DELINEATED HEREIN. THE EXPLOSIVE CLASSIFICATION OF OTHER ITEMS MAY BE DIFFERENT THAN WHAT IS SHOWN.
- REGARDLESS OF THE QUANTITY OF BOXES TO BE PALLETIZED, THE TOTAL WEIGHT OF ANY PALLET UNIT WILL NOT EXCEED 4,000 POUNDS. WHEN THE TOTAL WEIGHT OF A FULLY LOADED PALLET UNIT EXCEEDS 4,000 POUNDS, ONE OR MORE LOADED BOXES MUST BE REMOVED, AND EITHER FILLER ASSEMBLIES, AS DEPICTED BELOW, OR EMPTY BOXES MUST BE SUBSTITUTED THEREFORE. FOR ADDITIONAL GUIDANCE, SEE THE "PROVISIONS FOR LESS-THAN-FULL-LAYER LOADS" ON PAGE 5 OF THE BASIC UNITIZATION PROCEDURES DRAWING 19-48-4116-20PA1002.

BILL OF MATERIAL

LUMBER	LINEAR FEET	BOARD FEET
1" X 4"	16.00	5.33
2" X 6"	19.00	19.00
NAILS	NO. REQD	POUNDS
6d (2")	48	0.28
PALLET, 40" X 48"	1 REQD	80 LBS
STEEL STRAPPING, 1-1/4"	82.67 REQD	11.81 LBS
SEAL FOR 1-1/4" STRAPPING	6 REQD	NIL
STAPLE	24 REQD	NIL

FILL PIECE, 1" X 4" X 8-1/4" (2 REQD). NAIL TO THE VERTICAL PIECE W/3-6d NAILS.

VERTICAL PIECE 2" X 6" X 14-1/2" (2 REQD).

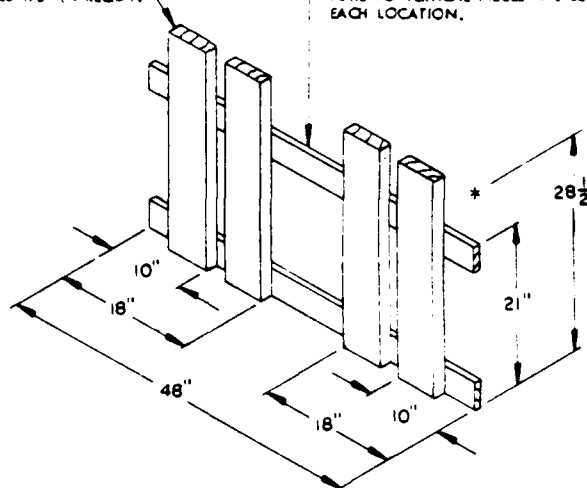


FILLER ASSEMBLY
(FOR MINUS ONE BOX)

HORIZONTAL PIECE, 2" X 4" X 18" (4 REQD). NAIL TO VERTICAL PIECES W/2-10d NAILS AT EACH JOINT.

VERTICAL PIECE, 2" X 6" X 28-1/2" (4 REQD).

HORIZONTAL PIECE, 1" X 4" X 48" (2 REQD). NAIL TO VERTICAL PIECES W/3-6d NAILS AT EACH LOCATION.



SUPPORT GATE
(2 REQD).